

# Conductivity Sensors

For additional information, please visit our website  
at [www.emersonprocess.com/raihome/liquid/](http://www.emersonprocess.com/raihome/liquid/).



## CAUTION

### SENSOR/PROCESS APPLICATION COMPATIBILITY

The wetted sensor materials may not be compatible with process composition and operating conditions. Application compatibility is entirely the responsibility of the user.



## CAUTION

BEFORE REMOVING THE SENSOR, be absolutely certain the process pressure is reduced to 0 psig and the process temperature is at a safe level!

## SENSOR SPECIFICATIONS

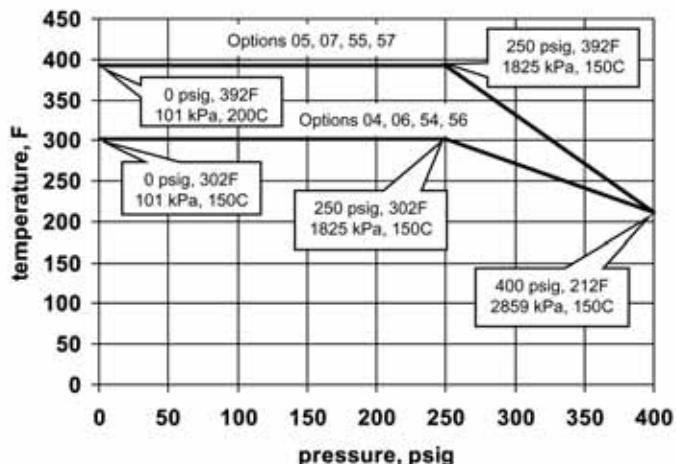
SPECIFICATIONS	MODEL 140	MODEL 141	MODEL 142
Wetted Materials	316SS, PEEK, Viton <sup>1</sup>	316SS, PEEK, Viton <sup>1</sup>	316SS, Viton <sup>1</sup> PEEK (high temp options), Kel-F <sup>2</sup> (stand temp options)
Temperature (standard)	302°F (150°C) max	see graph	see graph
Temperature (high temp)	392°F (200°C) max	see graph	see graph
Maximum Pressure	100 psig (791 kPa abs)	see graph	see graph

## INSTALLATION HARDWARE FOR 140 SENSOR

SPECIFICATION	Ball valve kit (PN 23724-00)	Fitting kit (PN 23730-00)
Wetted Materials	316SS	316SS, PEEK

Viton<sup>1</sup> is a registered trademark of DuPont Performance Elastomers.

Kel-F<sup>2</sup> is a registered trademark of 3M



## INSTALLATION

Keep 1/4 inch (6 mm) clearance between electrodes and piping. The electrodes must be completely submerged in the process liquid, i.e., to the level of the threaded connection. See Figure 1 for recommended orientation.

If the sensor is installed in a side stream with the sample draining to open atmosphere, bubbles may accumulate on the electrodes. Trapped bubbles will cause errors. As bubbles accumulate, the conductivity reading drops. To control bubble formation, apply a small amount of back pressure to the drain.

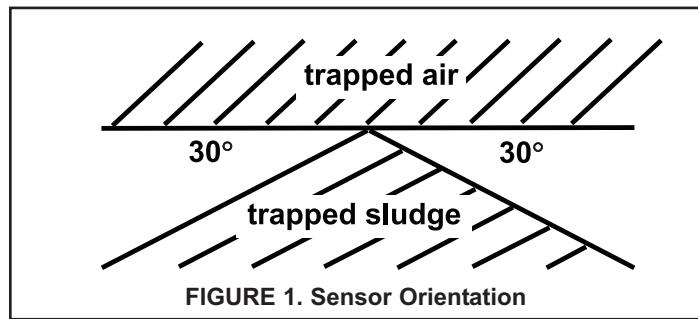


FIGURE 1. Sensor Orientation

### INSTALLATION – 140 SENSOR WITH BALL VALVE KIT (PN 23724-00)\*

1. Install the sensor in either a 1-inch NPT weldalet or in a 1-inch pipe tee.
2. Remove the plastic shipping cap from the sensor.
3. Screw the 1-inch hex nipple into the weldalet or pipe tee. See Figure 2. Use pipe tape on the threads.
4. Position the sensor for easy access to the ball valve handle, sensor compression fitting nut, and junction box.
5. Make sure the ball valve is in the fully open position.
6. Finger tighten the sensor compression fitting nut. Do not over tighten because the next step is to press the sensor into the process pipe.
7. Insert the sensor tube until the sensor tip is no closer than 1 inch (25 mm) from the far wall of the process pipe. See Figure 2.
8. Tighten the sensor compression fitting nut to hold the sensor tip in position. See Figure 2 for instructions.

\*If the ball valve assembly is already in place and the process line is pressurized, refer to **Inserting the 140 Sensor Section on page 6**.

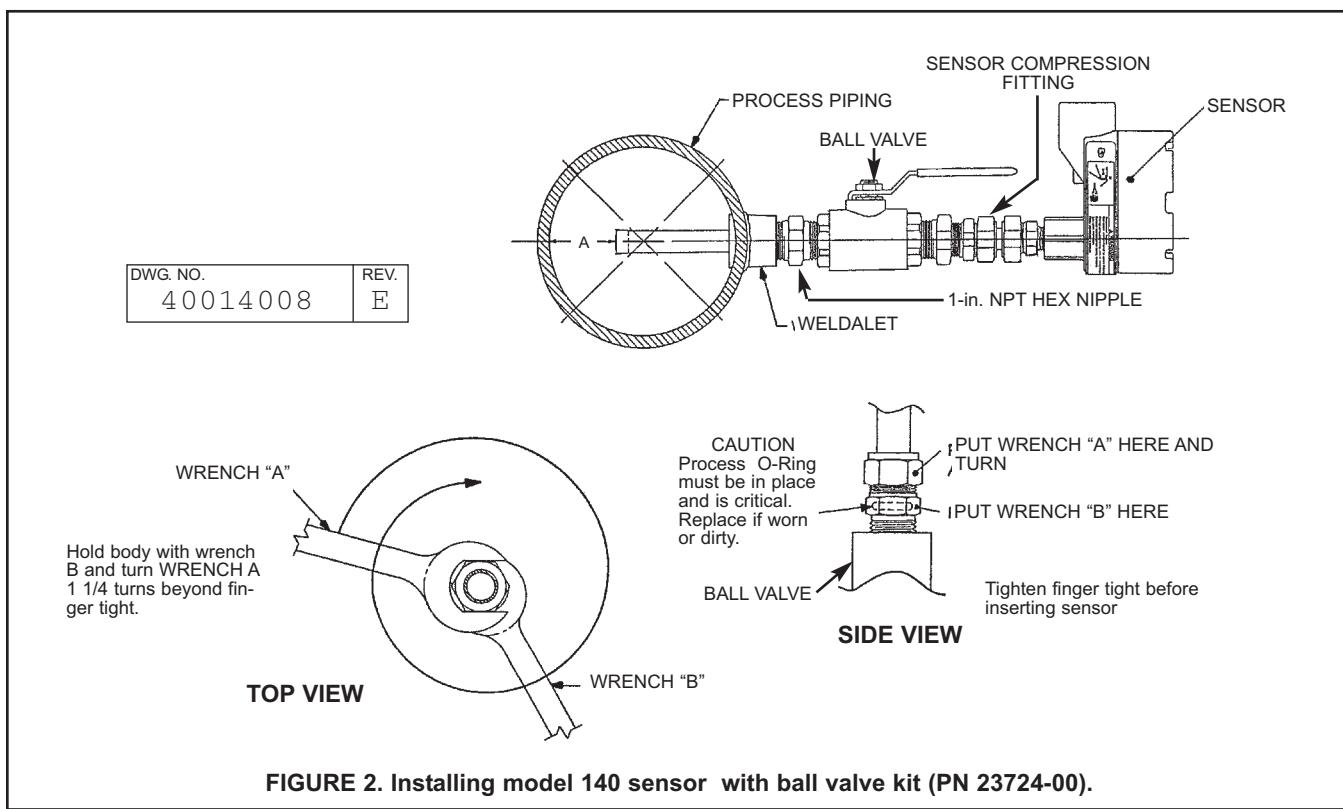


FIGURE 2. Installing model 140 sensor with ball valve kit (PN 23724-00).

**INSTALLATION – 141 SENSOR**

1. Install the sensor in a 3/4-inch NPT weldalet or in a 1-inch pipe tee.
2. Remove the plastic shipping cap from the sensor.
3. Screw the sensor into the fitting. Use pipe tape on the threads. See Figure 3.

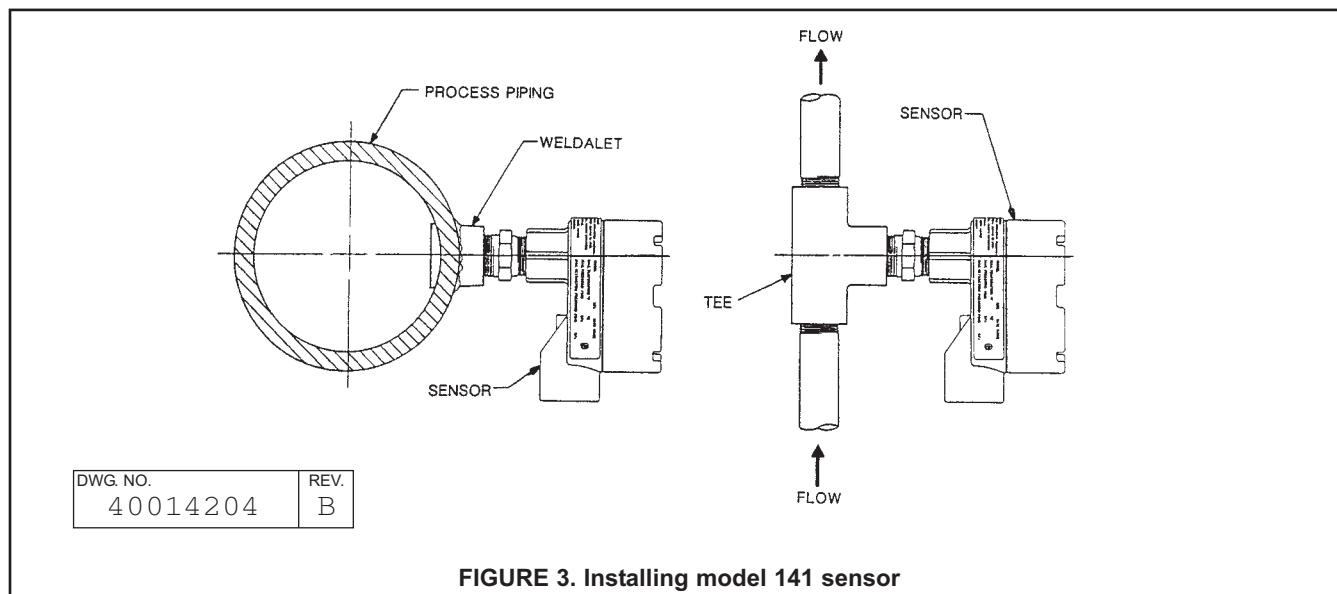


FIGURE 3. Installing model 141 sensor

**INSTALLATION – 142 SENSOR**

1. Install the sensor in a 3/4-inch NPT weldalet or in a 1-inch pipe tee. See Figure 4.
2. Remove the plastic shipping cap from the sensor.
3. Screw the sensor into the fitting. Use pipe tape on the threads. DO NOT tighten the sensor compression fitting until the sensor is correctly positioned.
4. If necessary, loosen the sensor compression fitting and position the sensor so that the tip of the sensor is at least 1-inch (25 mm) from the far wall of the pipe.
5. Tighten the compression fitting using the procedure shown in Figure 2.

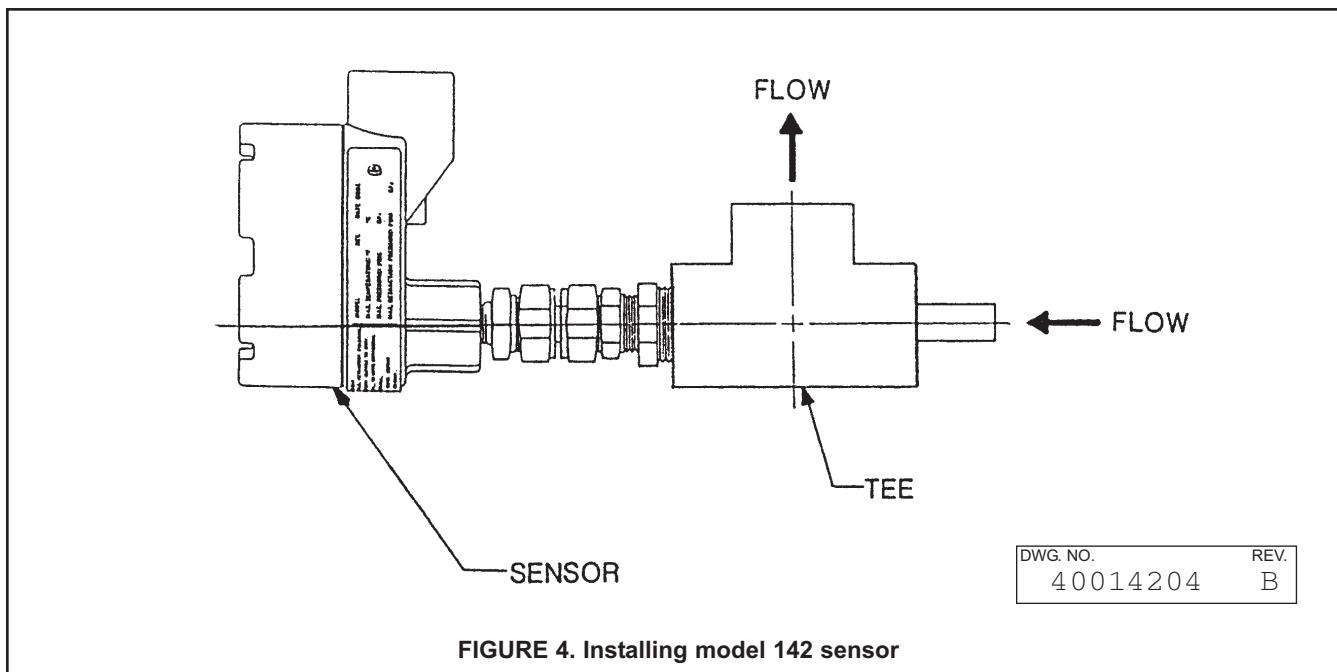
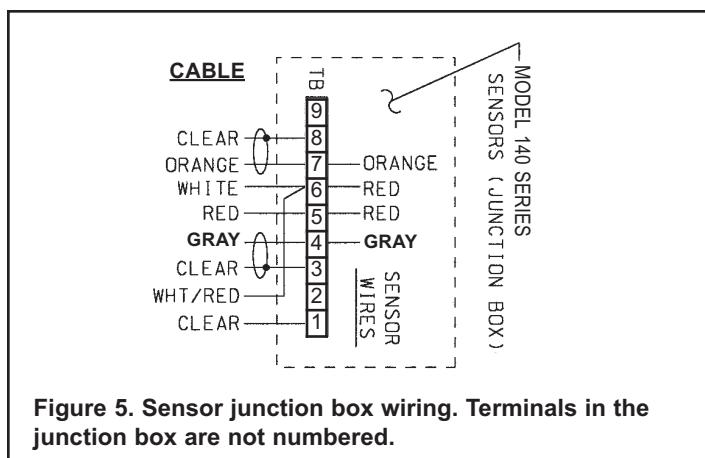


FIGURE 4. Installing model 142 sensor

## WIRING

All 140 series sensors have a junction box mounted on the back of the sensor. Wiring connections in the junction box are shown in Figure 5.

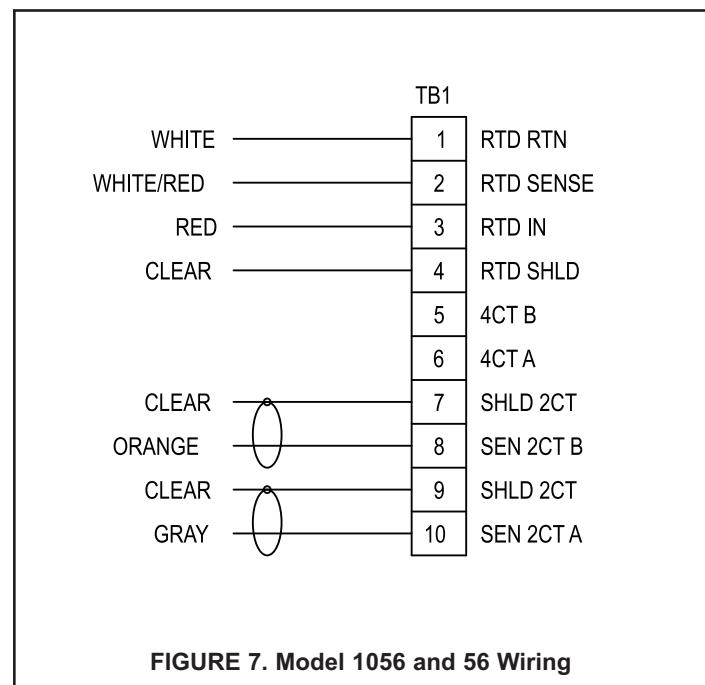
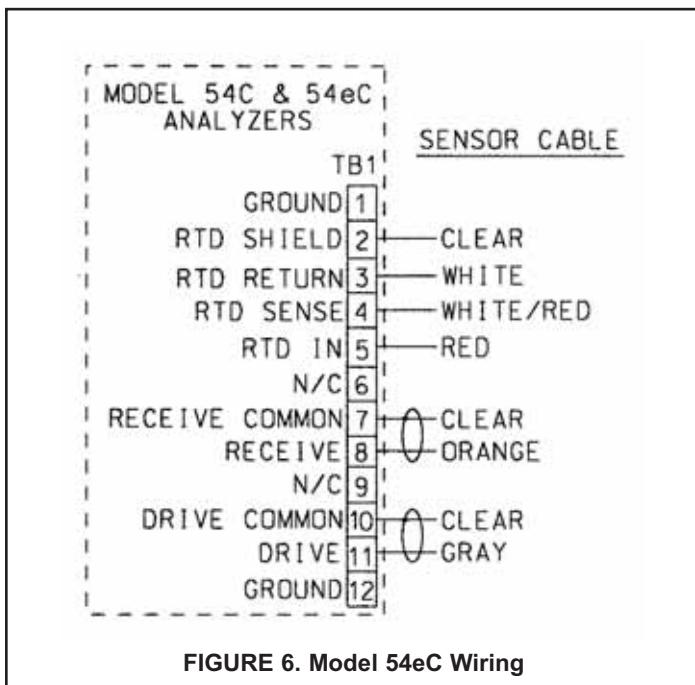


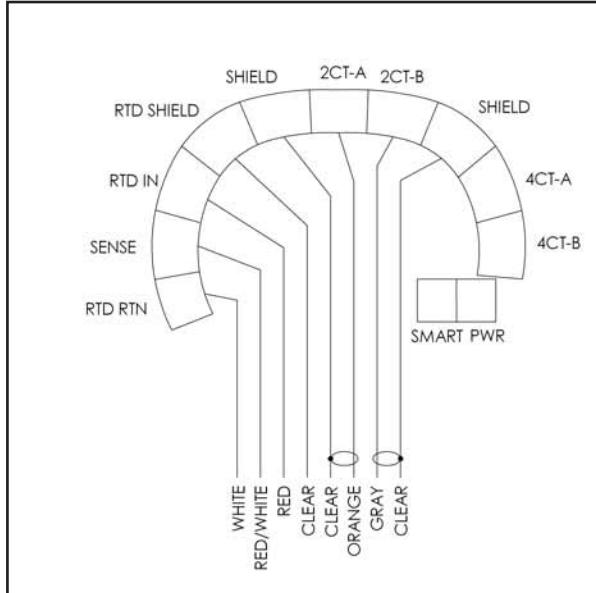
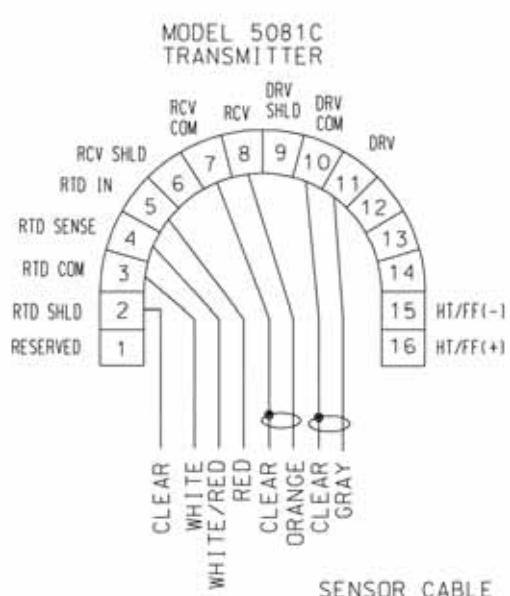
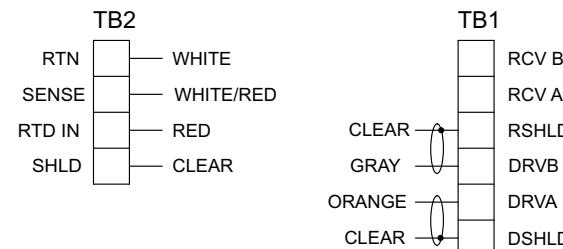
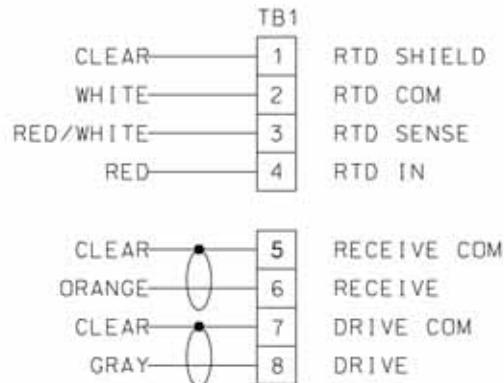
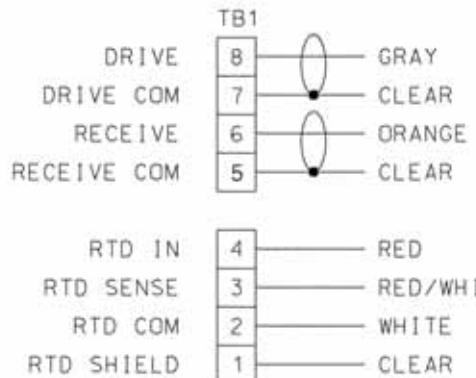
141 and 142 sensors have one gray wire (shown). The 140 sensor has two gray wires attached to the terminal.

### WIRE COLOR AND CONNECTIONS IN SENSOR

COLOR	FUNCTION
Gray	Connects to outer electrode
Clear	Coaxial shield for gray wire
Orange	Connects to inner electrode
Clear	Coaxial shield for orange wire
Red	RTD in
White with red stripe	RTD sense
White	RTD return
Clear	Shield for all RTD lead wires

### WIRING DIAGRAMS





## RETRACTING AND INSERTING THE MODEL 140 SENSOR



Model 140 sensors are retractable. BEFORE RETRACTING THE SENSOR, be absolutely certain the process pressure is less than 100 psig (791 kPa abs) and the process temperature is at a safe level!

### RETRACTING THE SENSOR

1. Push in on the sensor junction box and slowly loosen the sensor compression fitting nut by reversing the sensor tightening procedure illustrated in Figure 2.
2. When the sensor compression nut is completely unscrewed, slowly ease the sensor out until the flared tip of the electrode rests firmly within the body of the compression fitting body.
3. Close the ball valve completely.



Before removing the sensor be sure the ball valve is completely closed.

4. Unscrew the compression fitting body from the reducing bushing and remove the sensor from the ball valve assembly.

### INSERTING THE SENSOR



Make sure process O-ring is clean, lubricated, and in place before installing sensor. Replace if worn.

1. DO NOT open the ball valve.



The system pressure must be less than 100 psig (791 kPa).

2. Thread the sensor compression fitting body into the reducing bushing in the rear of the ball valve and tighten.  
**NOTE:** Do not push past this point. Damage to the sensor could result.



If the sensor comes free of the valve, refer to Figures 2 and 13 and verify that the valve and associated fittings are as shown. Do not proceed until the sensor is correctly restrained.

3. Slowly open the valve.



**Stand clear of the sensor.**

4. Insert the sensor up to the desired insertion depth and turn the sensor compression fitting nut until it is finger tight.
5. Position the entire sensor for easy access to the ball valve handle, sensor compression fitting nut and J-box terminal block.
6. Tighten sensor compression fitting nut.



For initial installation of the sensor, tighten the compression fitting nut 1-1/4 turns after finger tight. If it is a **reinstallation**, turn no more than 1/4 to 1/2 additional turns!

## REMOVING AND REINSTALLING THE MODEL 142 SENSOR

### REMOVING THE SENSOR



Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is lowered to a safe level!

1. Reduce process temperature and pressure to a safe level. If necessary drain the process line.
2. Loosen the sensor compression fitting and slowly slide the sensor from the pipe fitting or weldalet.

### REINSTALLING THE SENSOR

1. Slide the sensor into the process fitting and position the sensor the way it was originally installed.



Be sure the sensor is in the original position. The sensor tube takes a permanent set and could become weakened if the new set is adjacent to the original set.

2. Tighten the sensor compression fitting 1/4 to 1/2 turn after it is finger tight.

## CALIBRATION

Model 140 sensors are not calibrated at the factory. The cell constant on the label is a nominal value only. The true cell constant can differ from the nominal value by as much as  $\pm 5\%$ . For improved accuracy, calibrate the sensor using either a solution of known conductivity or a referee meter and sensor. If using a standard solution, choose one having conductivity in the recommended operating range for the sensor cell constant. Refer to the analyzer manual or product data sheet and use the range recommended for Model 400 series sensors. For the 0.2/cm cell constant Model 140 sensor, use the range for the 0.1/cm Model 400 sensor and multiply the upper and lower limits by two.

Do not use standard solutions having conductivity less than about 100  $\mu\text{S}/\text{cm}$  for calibration. They are susceptible to contamination by atmospheric carbon dioxide, which can alter the conductivity by a variable amount as great as 1.2  $\mu\text{S}/\text{cm}$  (at 25°C). Because 0.01/cm sensors must be calibrated in low conductivity solutions, they are best calibrated against a referee meter and sensor in a closed system.

For more information about calibrating contacting conductivity sensors, refer to application sheet ADS 43-024, available on the Rosemount Analytical website.

## MAINTENANCE

### CLEANING THE SENSOR

Use a warm detergent solution and a soft brush or pipe cleaner to remove oil and scale. Isopropyl alcohol can also be used to remove oily films. Avoid using strong mineral acids to clean conductivity sensors.

### CHECKING MODEL 140 RETRACTION RESTRAINT

The integrity of the Model 140 will become compromised if the flared tip of the electrode is allowed to blow out against the compression fitting body. In the event a blowout occurs, replace the sensor.

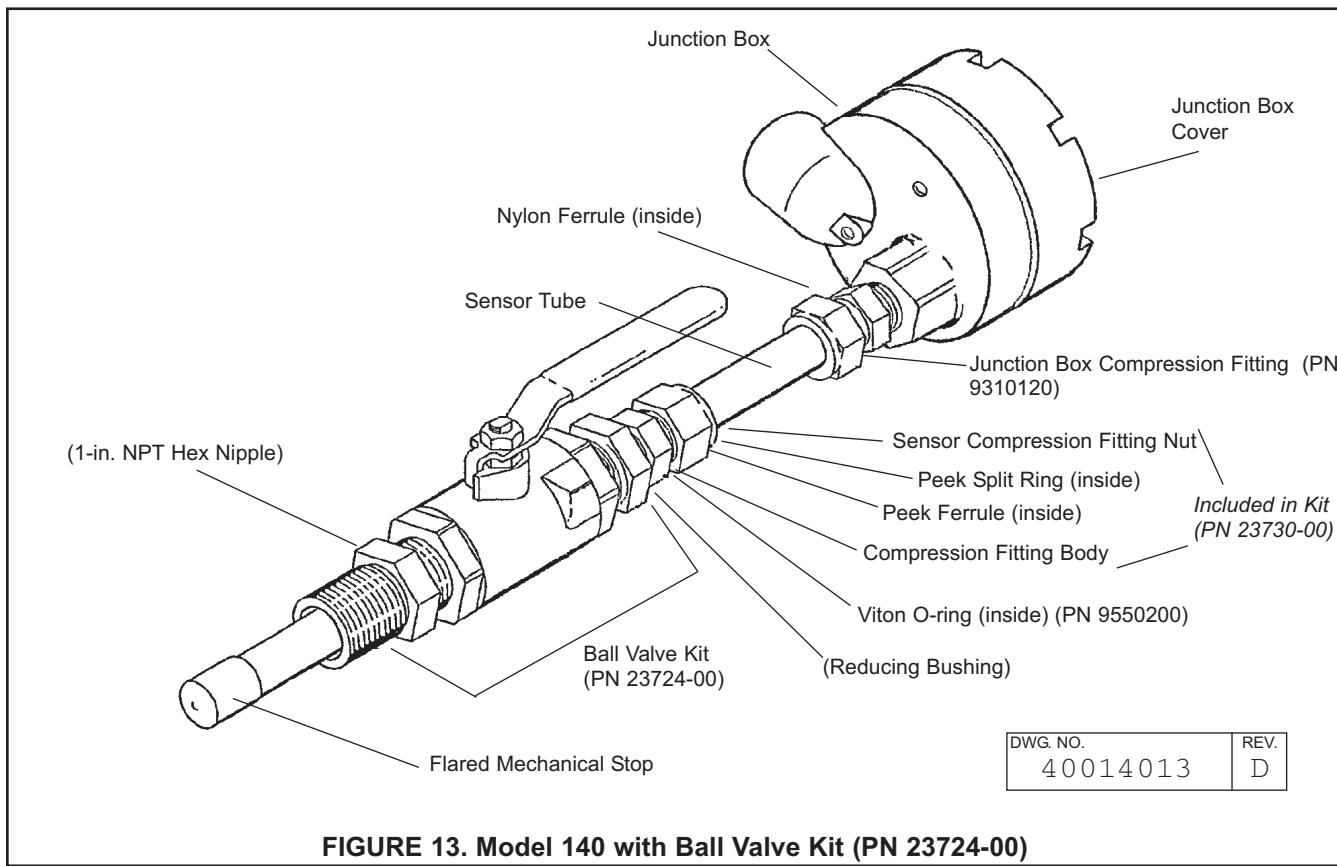
### REPLACING MODEL 140 SENSOR SEAL.

If the process seal is leaking owing to a pitted or uneven sensor tube, a replacement sensor is required. If the sensor tube surface is smooth and clean yet the process seal is leaking, the process O-ring is damaged and requires replacement according to the following procedure (see Figure 2). Replacement parts can be obtained from the Process Fitting Rebuild Kit (PN 23731-00).

1. The junction box with attached compression fitting body, nut and compression fitting must be recovered from the sensor for reuse. Unscrew the junction box cover and set aside. Mark and disconnect the electrical connections from the terminal block. Remove the junction box compression fitting nut from the compression fitting body and separate the junction box from the sensor tube.
2. Remove the nylon ferrule and snap ring (discard both). Remove and save the junction box compression fitting nut.
3. Slide off the sensor compression fitting nut and set aside for reuse. Slide off the remaining PEEK ferrule and split ring (discard both).
4. Remove the sensor compression fitting body and replace the Viton O-ring. Lubricate the O-ring with the barium based lubricant provided.
5. Wrap the threads of the sensor compression fitting body with pipe tape and slide the body on to the sensor tube.
6. Slide on a new PEEK ferrule, beveled side facing the electrode tip, and a new PEEK split ring, flared end towards electrode tip. Slide on the sensor compression fitting nut and thread it onto the compression fitting body. Finger tighten.
7. Reinstall the J-box on the sensor tube. Finger tighten the J-box compression fitting nut. Use a wrench to turn the nut a 1/4 to 1/2 additional turn.

## REPLACEMENT PARTS

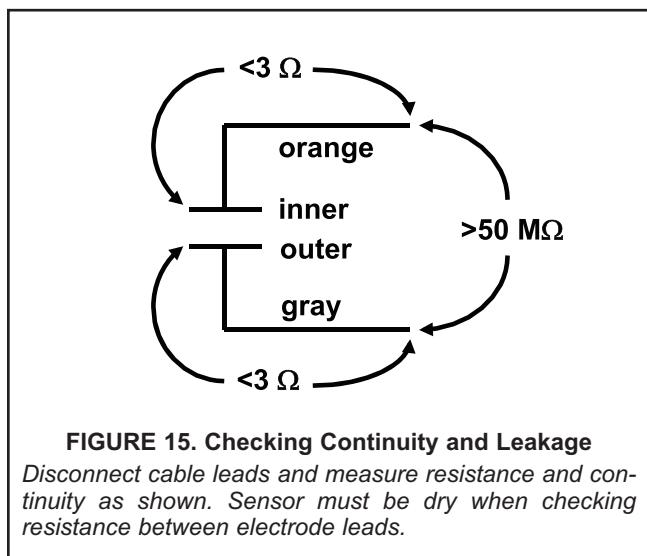
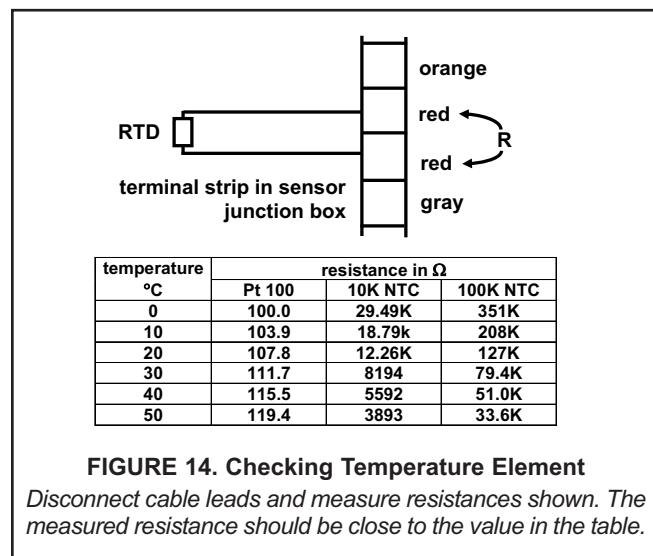
PN	Description
23724-00	Ball valve kit for Model 140 sensor
23730-00	Process compression fitting kit (3/4-inch NPT) for Model 140 sensor
23731-00	Process fitting rebuild kit for Model 140 sensor (includes ferrule, split ring, O-ring, lubricant)
9310120	Junction box compression fitting for Model 140 sensor
9550200	O-ring, 2-116, Viton for Model 140 sensor
3001882	Process compression fitting (3/4-inch NPT) for Model 142 sensor

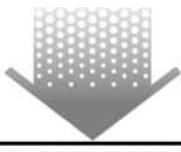


**FIGURE 13. Model 140 with Ball Valve Kit (PN 23724-00)**

## TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
Off-scale reading	Wiring is wrong.	Verify wiring.
	Temperature element is open or shorted.	Check temperature element for open or short circuits. See Figure 14.
	Sensor is not in the process stream.	Be sure the sensor is completely submerged in the process stream.
	Sensor has failed.	Perform isolation checks. See Figure 15.
Noisy reading	Sensor is improperly installed in the process stream.	Be sure sensor is completely submerged in process stream.
Reading seems wrong (lower or higher than expected)	Bubbles trapped in the sensor.	Be sure the sensor is properly oriented in the pipe or flow cell. See Figure 1. Apply back pressure to the flow cell.
	Wrong temperature correction algorithm.	Check that the temperature correction is appropriate for the sample. See analyzer manual for more information.
	Wrong cell constant.	Verify that the correct cell constant has been entered in the analyzer and that the cell constant is appropriate for the conductivity of the sample. See analyzer manual.
Sluggish response	Electrodes are fouled.	Clean electrodes.
	Sensor is installed in a dead area in the piping.	Move the sensor to a location more representative of the process liquid.





*The right people,  
the right answers,  
right now.*

ROSEMOUNT ANALYTICAL  
CUSTOMER SUPPORT CENTER  
1-800-854-8257



**Emerson Process Management**

2400 Barranca Parkway  
Irvine, CA 92606 USA  
Tel: (949) 757-8500  
Fax: (949) 474-7250

<http://www.raihome.com>



*Specifications subject to change without notice.*

Credit Cards for U.S. Purchases Only.



  
**EMERSON**  
Process Management

© Rosemount Analytical Inc. 2010